CHAPTER 2

AIR POLLUTION

Ask people to define the term ***air pollution*** and most of them will mention dirty air or **smog**, that harmful mixture of **mist**, **exhaust fumes** or smoke that is found in big cities all around the world. But there is much more to air pollution than dirty air. Air pollution threatens everyone and is responsible for some of the biggest environmental problems facing the world today: **acid rain**, **ozone depletion**, and the possibility of **global climate change**.

Air pollution has been selected as the theme for this second chapter of the Environmental Education volume because it is a major environmental problem that threatens the health of human beings and other living things all over the world. In this introductory lesson, students learn about some of the signs of air pollution and its harmful effects on humans. While discussing the sources and effects of air pollution, students improve their language skills by learning and using new vocabulary and concepts associated with the topic. By examining the effects of air pollution on themselves and their own community, students can begin to appreciate how important it is to maintain good air quality.

Air pollution is a huge topic. A 50-minute lesson, such as the one outlined in the section on **Classroom Applications**, provides only a brief overview of some of the issues that are involved. In this introductory lesson, students consider what they already know about air pollution: what it is, its causes, and its effects. If time allows, teachers are advised to combine or follow up this lesson with some of the materials outlined in the section on **Internet Resources** to create a more extensive teaching unit.

BACKGROUND INFORMATION

What is Air Pollution?

Air pollution is any visible or invisible substance found in the air that is not part of the normal composition of air. Some air pollution is natural and has always been a part of the earth's history. However, over the past one hundred years or so, pollution created by humans has become a major environmental problem.

Why Worry About Air Pollution?

Air pollution affects everyone. It is a threat to the health of human beings and many other living things on the planet. **Pollutants** in the air produce smog and acid rain. They also cause **cancer** and many other serious health problems. They cause ozone depletion in the upper **atmosphere**, and they increase the possibility of global climate change. Most people are familiar with visible air pollution, like smog, but some of the most dangerous air pollutants are invisible to the human eye. Since polluted air can move from region or area to another, it has the possibility of affecting nearly everyone on earth.

What Causes Air Pollution?

Air pollution is not new. Natural air pollution has been around for millions of year. Dust and a variety of gases from forest fires, volcanoes, and decaying material in rivers, oceans, and other bodies of water continually enter the atmosphere. Sometimes this natural pollution can have dramatic effects. For example, scientists believe that natural gas from plant **decay** may have been one of the main causes of global climate change in the past.

Of course, not all air pollution is produced naturally. The atmosphere contains pollutants produced by humans, and these man-made pollutants present a far more serious problem than natural air pollution. Man-made pollutants are not only sometimes more harmful, but they are usually concentrated over large cities where large populations of people live and work.

MAJOR TYPES OF AIR POLLUTION

TYPE	SOURCES	SIGNS/EFFECTS
Ozone	• motor vehicles • other machines	• eye problems • **lung** problems • **respiratory** problems
Carbon Monoxide	• motor vehicles • small engines • parking garages • tunnels • heavy traffic	• headaches • dizziness • **fatigue** • death • heart damage
Nitrogen Oxides	• motor vehicles • power plants burning **fossil fuels** • coal-burning stoves	• lung problems • acid rain • forest damage • damaged buildings and statues • smog
Particulate Matter	• diesel engines • power plants • industries • dust in the wind • wood-burning stoves	lung problems • eye problems • discolored buildings and statues • reduced **visibility**
Sulfur Dioxide	coal-burning power plants and industries • coal-burning stoves • **refineries**	• smog • eye problems • lung damage • kills life in lakes and rivers • acid rain • damages buildings and statues
Lead	• vehicles using leaded gasoline • metal refineries	• brain damage • **kidney** damage

WHAT CAN BE DONE ABOUT AIR POLLUTION?

Little can be done about natural pollution, but people can do something about the air pollution caused by humans. More and more people are becoming concerned about the pollutants that come from human activity, and there are a number of ways they can take action and get involved. Here are some of them:

- Reduce the amount of time you spend in cars, and increase the number of people with whom you share rides.
- Go to work or school by bicycle, public bus, or train.
- Walk to work or school if the distance is not too great.
- Use only as much electricity as you need. This will reduce the amount of air pollution produced by power plants.
- Have home and car air conditioners checked for leaks.
- Grow houseplants that will absorb certain air pollutants and improve indoor air quality.
- Plant a tree to improve the environment and absorb carbon dioxide.
- Join or organize a program to check acid rain.

CLASSROOM APPLICATIONS

Preliminary Lesson Planning

Materials Preparation:

- Draw a K-W-L chart (What we KNOW, What we WANT to Know, and What we have LEARNED) on the board, overhead projector, or a large piece of paper. For a sample K-W-L chart, see **Appendix A**.
- Prepare a set of cards (or small slips of paper) with one question written on each. Use the questions below, and make enough cards to give one question to each group of three or four students in the class. If there are more than five groups of students in your class, make duplicate copies of some of the cards.
    - What are some signs of air pollution in your community?
    - What are the causes of air pollution in your community?
    - How does air pollution affect humans?
    - How does the quality of air in your community compare to communities close to you?
    - How does the quality of the air in your community compare to places far from you?

Vocabulary Considerations:

Consider the vocabulary that your students will need to know to complete the lesson successfully. Determine which vocabulary items they already know and which items will be new for them. Some important terms, and their definitions, are included in the **glossary**. Items listed in the glossary are written in **bold** print the first time they are mentioned in this chapter.

WARM UP ACTIVITY (APPROXIMATELY 5 MINUTES)

Purpose:

- To stimulate students' interest in the topic of air pollution
- To activate students' background knowledge of air pollution
- To allow students to express their initial ideas about air pollution
- To introduce and review key vocabulary related to the topic of air pollution

Procedure:

1. Write the phrase "air pollution" on the board. Ask students what they think the phrase means.
2. As student volunteers give their answers, write key words from their responses on the board. If students are unfamiliar with the concept of air pollution, be prepared to provide the class with some relevant information (see **Background Information** at the beginning of this chapter), adding words to the board as you introduce key ideas.
3. Tell the students that they already know something about air pollution, but there is probably more they want to know about it. Explain that in this lesson they are going to work together and share their ideas and questions about air pollution.

ACTIVITY #1 (APPROXIMATELY 15 MINUTES)

Purpose:

- To allow students to practice speaking, listening, and note-taking in a meaningful way
- To allow students to share their background knowledge and questions about air pollution
- To give students the opportunity to use key vocabulary and ideas associated with the topic of air pollution

Procedure:

1. Divide the class into groups of three or four students.
2. Show the class the K-W-L chart you have prepared, and explain the task to the students. They are to work together in groups. Each group should make its own copy of the K-W-L chart, writing the phrase "air pollution" in the space for the topic. Students will then discuss the topic of air pollution, and fill in the first two columns (What we KNOW and What we WANT to know) of their K-W-L charts to the best of their knowledge.

   Note: The third column of the K-W-L chart (What we have LEARNED) will be used in the Cool Down Activity at the end of the lesson.
3. Students work in groups, discussing the topic and making brief notes in the appropriate columns on their K-W-L charts.
4.

5. Volunteers from each group take turns reading their group's notes to the class. As the other students listen, encourage the listeners to ask for repetition and clarification if necessary.

ACTIVITY #2 (APPROXIMATELY 25 MINUTES)

Purpose:

- To allow students to practice speaking, listening, and note-taking in a meaningful way
- To have students identify possible sources and types of air pollution
- To reinforce and extend key concepts and vocabulary associated with the theme of air pollution

Procedure:

1. Tell students to stay in their original groups. Distribute the cards you have prepared. Give each group of students a card with a different question. Tell the groups to discuss the question for two minutes and write down their ideas on a piece of paper.
2. After two minutes, have groups exchange cards so that each group gets a new question. Continue this process until each group has had time to discuss each of the five questions.
3. Conduct a whole-class discussion centering on the five questions. Some possible answers are listed in parentheses below.

    a. What are some noticeable signs of air pollution?
    (Smoke, **odors**, **stunted** or **discolored** plants and trees, damaged or discolored buildings and statues)

    b. Where does the air pollution in your community come from?
    (Cars, trucks, local industries, local electric power plants, dry cleaners, gas stations, **windblown dust**)

    c. How does air pollution affect people?
    (**respiratory** problems, headaches, eye problems, brain, heart, and lung problems)

    d. How does the quality of air in your community compare to communities close to you?
    (Answers will vary.)

    e. How does the quality of the air in your community compare to places far from you?
    (Answers will vary.)

COOL DOWN ACTIVITY (APPROXIMATELY 10 MINUTES)

Purpose:

- To conclude the lesson
- To give students an opportunity to discuss the relevance of lesson

Procedure:

1. Call on student volunteers to respond to the question "What have you learned about air pollution today?"
2. As volunteers provide answers, write them in the third column (What we have LEARNED) of the K-W-L chart on the board.

EXTENSIONS

- Have students write a short summary on what they have learned about air pollution.
- Have groups of students brainstorm and write up a list of ways to reduce air pollution.
- Have groups of students prepare posters on different aspects of air pollution. For example, one group might prepare a poster on signs of air pollution; another on health affects of air pollution; a third on sources of air pollution.
- Students can research air pollutants and environmental problems that threaten the atmosphere (e.g., acid rain, global warming).

Refer to the **Internet Resources** section for more information and lesson planning ideas.

Sample K-W-L Chart		
Topic:		
What we KNOW (K)	What we WANT to know (W)	What we have LEARNED (L)

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